Status of GERB-3 and GERB-4 products and validation

RMI, Brussels
Christine Aebi, Johan Moreels, Edward Baudrez and Nicolas Clerbaux

Imperial College, London
Jacqueline E. Russell, Helen Brindley and James Rufus

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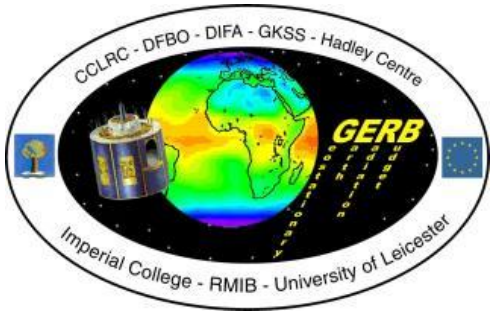
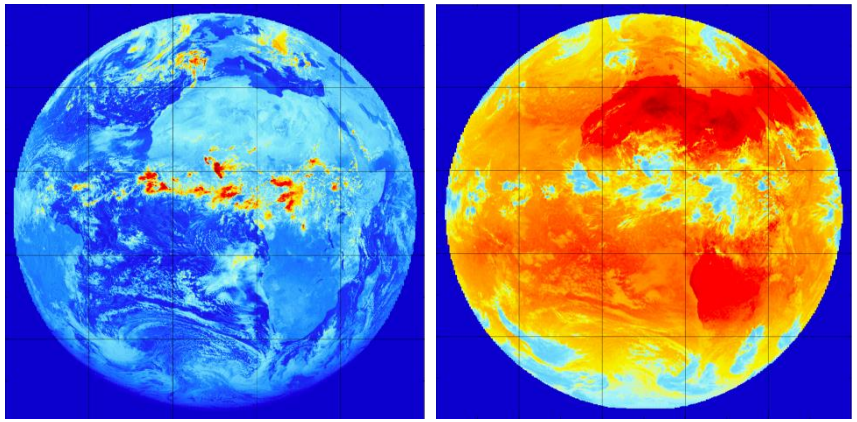


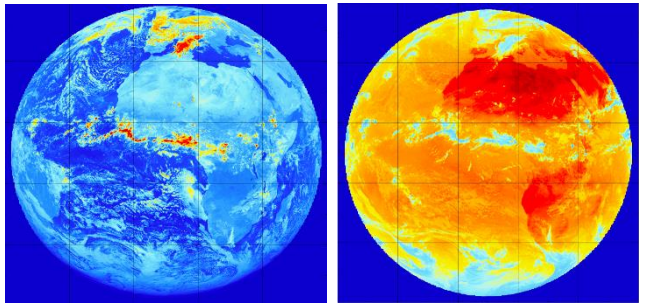
RMI

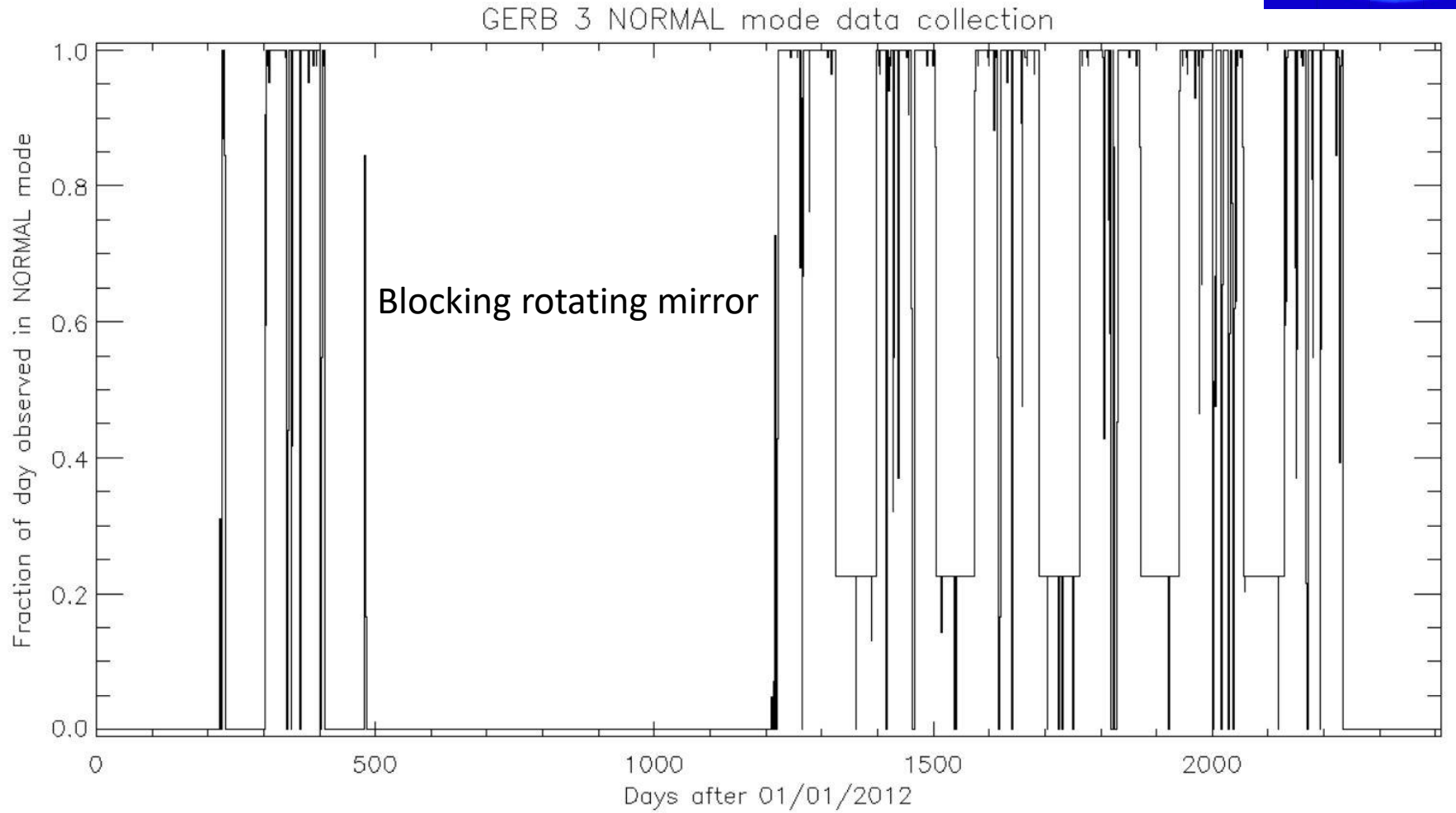
GERB-3 and GERB-4: Overview

- Meteosat-10 (MSG-3) with GERB-3 launched on July 5, 2012
- Meteosat-11 (MSG-4) with GERB-4 launched on July 15, 2015
- Location: Longitude 0°
- Operational:
  - GERB-3: 21/01/2013 – 20/02/2018
  - GERB-4: 20/02/2018 - today
- Data available at: ftp://gerb.oma.be
  - ➢ Data are not yet released for science, only for evaluation etc.



GERB-3 L1.5 Data Availability





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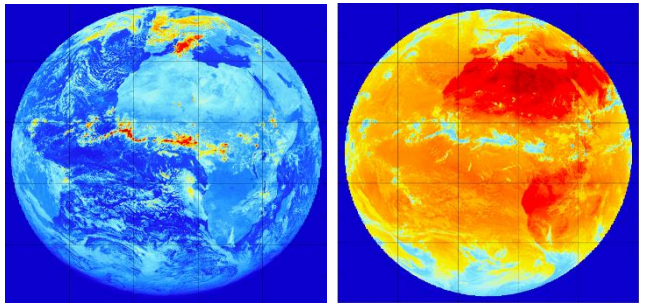

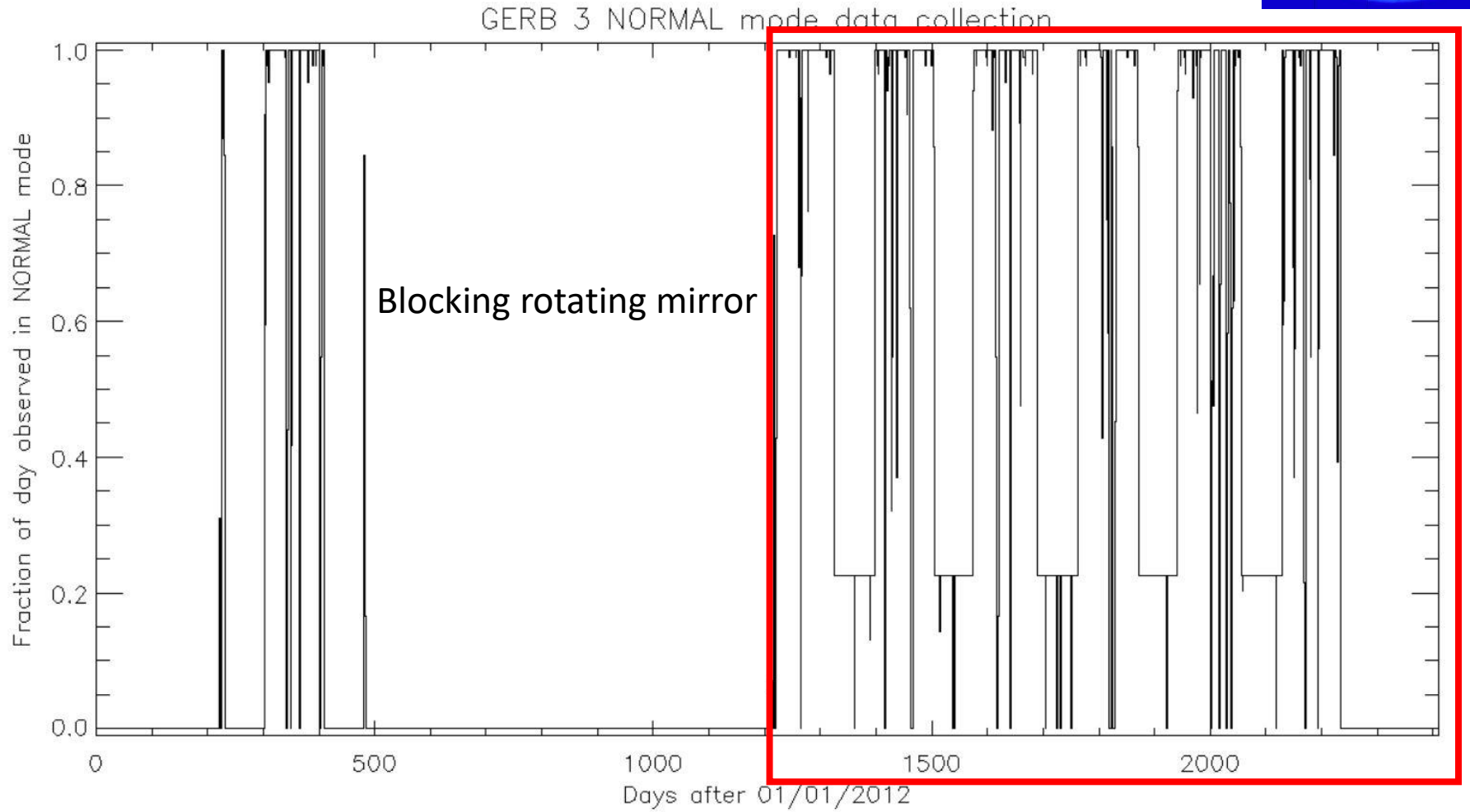

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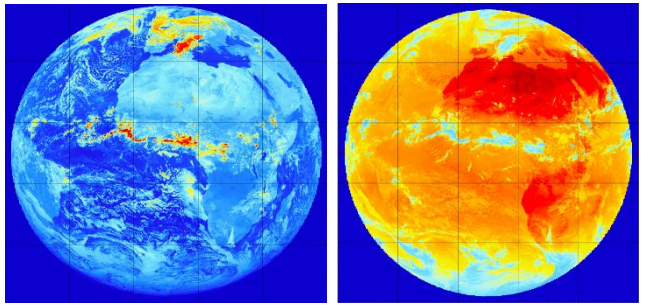

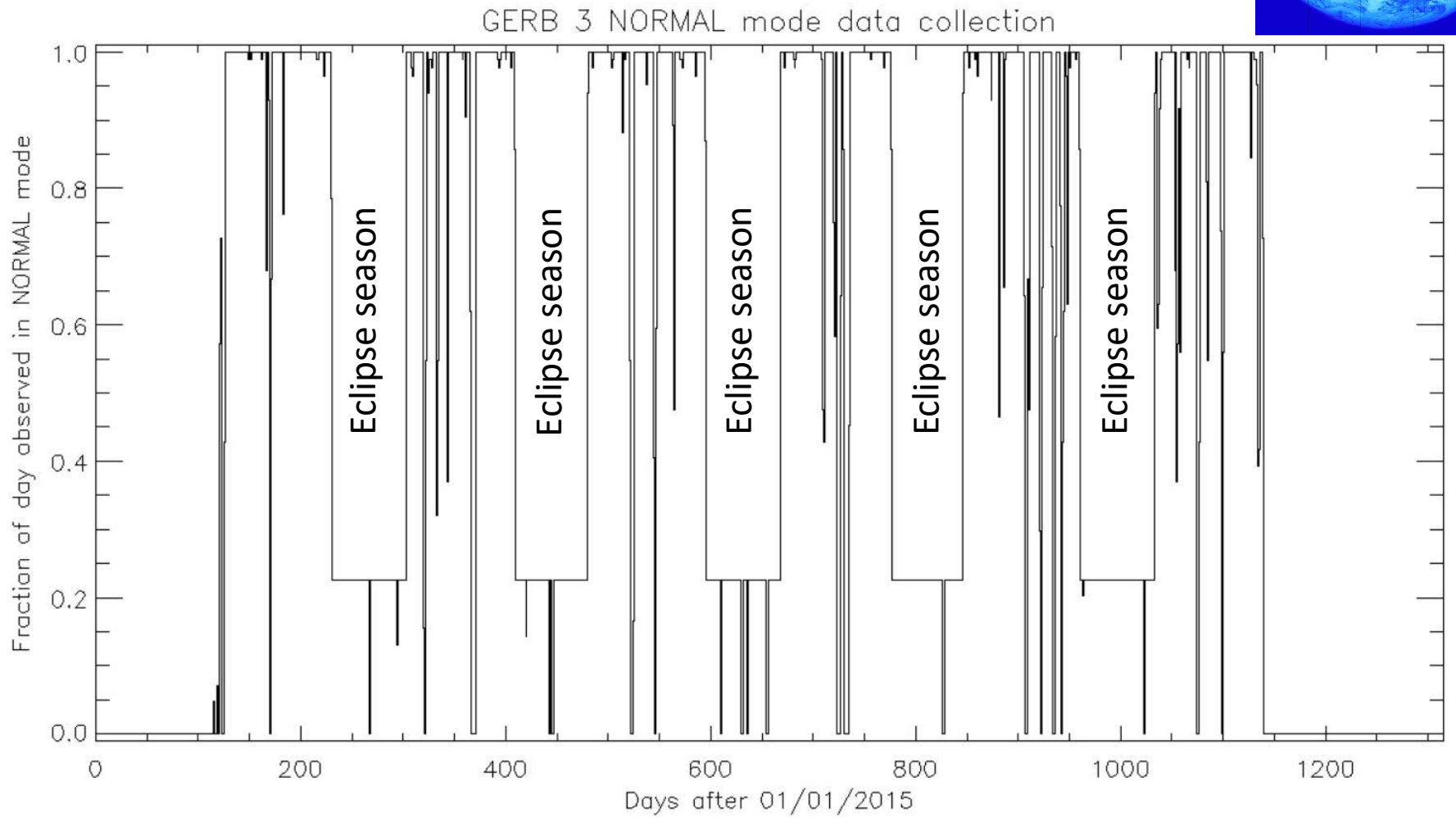

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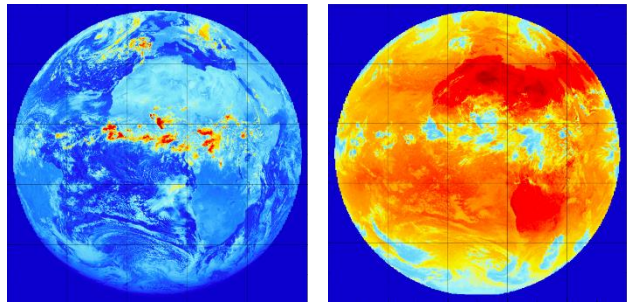
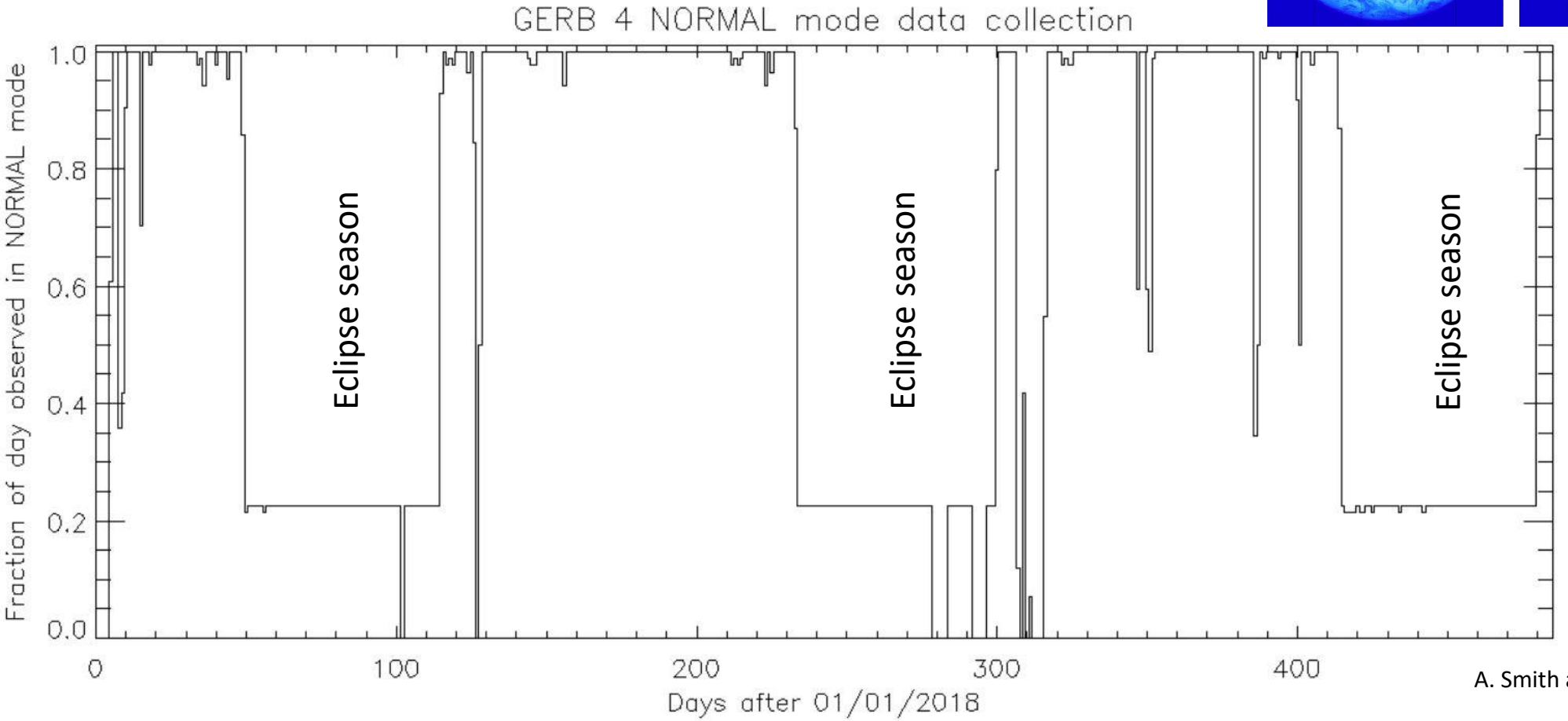
GERB-4 L1.5 Data Availability





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Validation: Overview

GERB:

- G1 – G4
- Products (HR, ARG, BARG, NRT)
- Radiance and flux (SW, LW)
- L1.5 and L2
- Versions and Editions
- Instantaneous/daily/monthly mean

Validation: Overview

GERB L1.5:
- Different surface types (ocean, desert, DCC)
- Stability of SW retrieval

GERB-like:
- Internal product with same processing as GERB data
- Differences day/night

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CERES Ed4:
- Different instruments (FM1 – FM4)
- Instantaneous/daily/monthly mean (SSF, EBAF, SYN1deg)

GERB:
- Overlap period
- Overlap region (Indian Ocean vs. 0°)
- Different version/edition

ERA5:
- Reanalysis data

Validation: G1 and G2

- Comparison SW flux GERB – CERES SSF Ed3 to validate the stability of the SW flux (Parfitt et al., 2016).
- Comparison flux and radiance products with CERES SSF Ed2 (Clerbaux et al., 2009).
- Quality summary GERB L2 Ed1 (Russell et al., March 2017).

→ Focusing on G3 and G4

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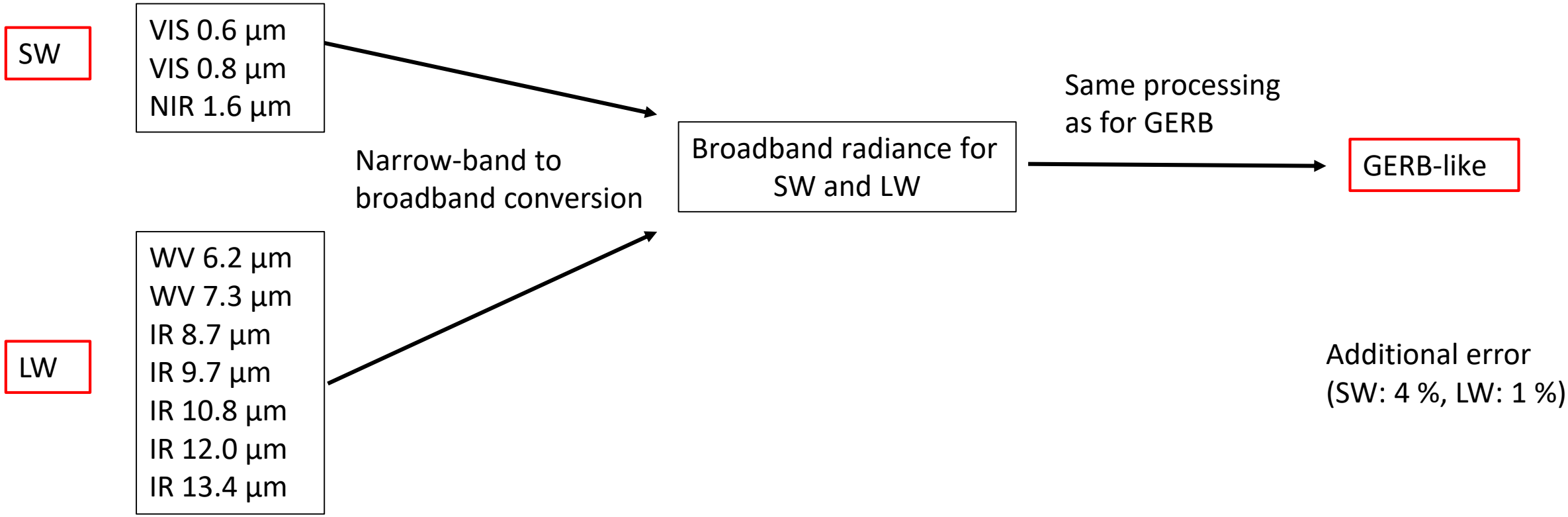
- Different version/edition

ERA5:
- Reanalysis data

Validation: GERB – GERB-like

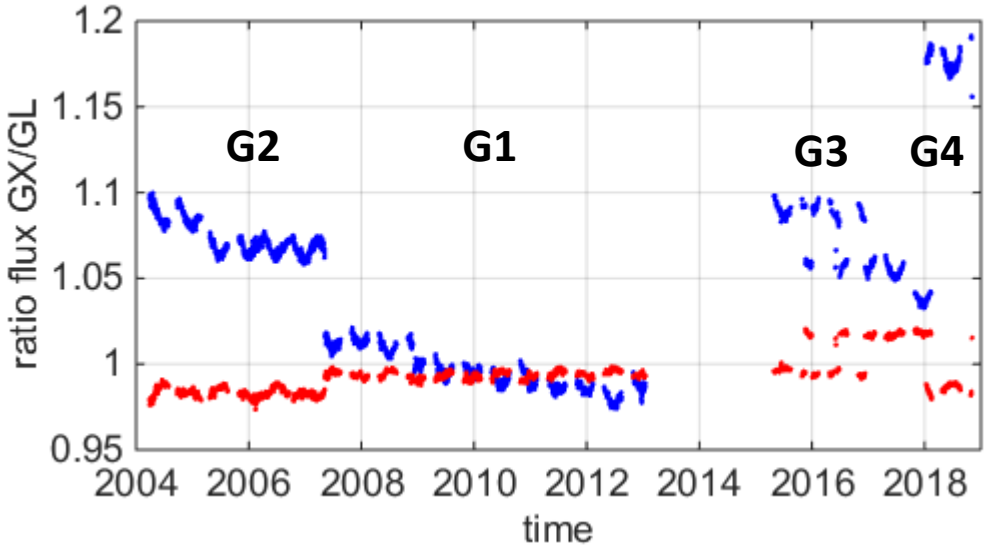
SEVIRI on Meteosat:



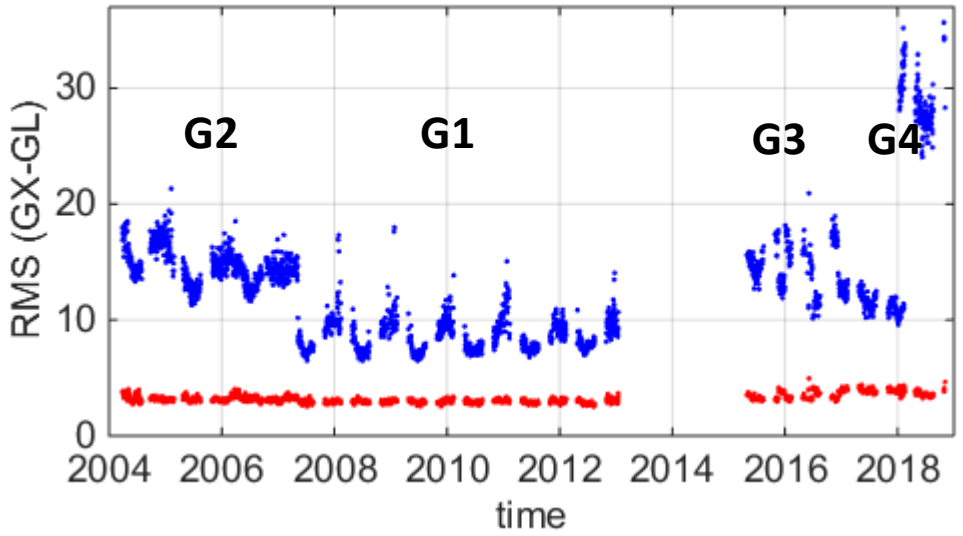
Additional error
(SW: 4 %, LW: 1 %)

Validation: GERB – GERB-like: L2, HR, 12:00 UTC

Ratio flux GX/GL **uncorrected** SW LW



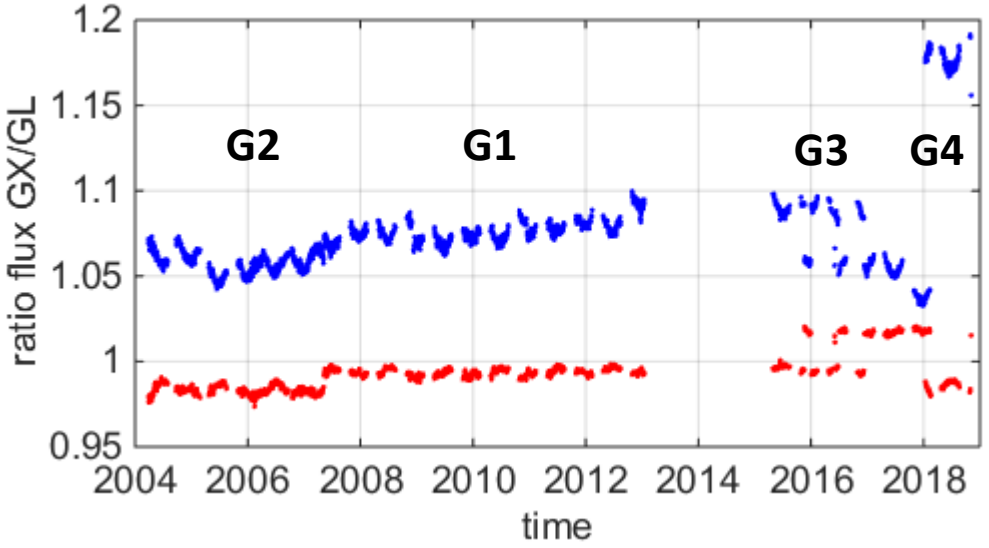
RMS (GX-GL)



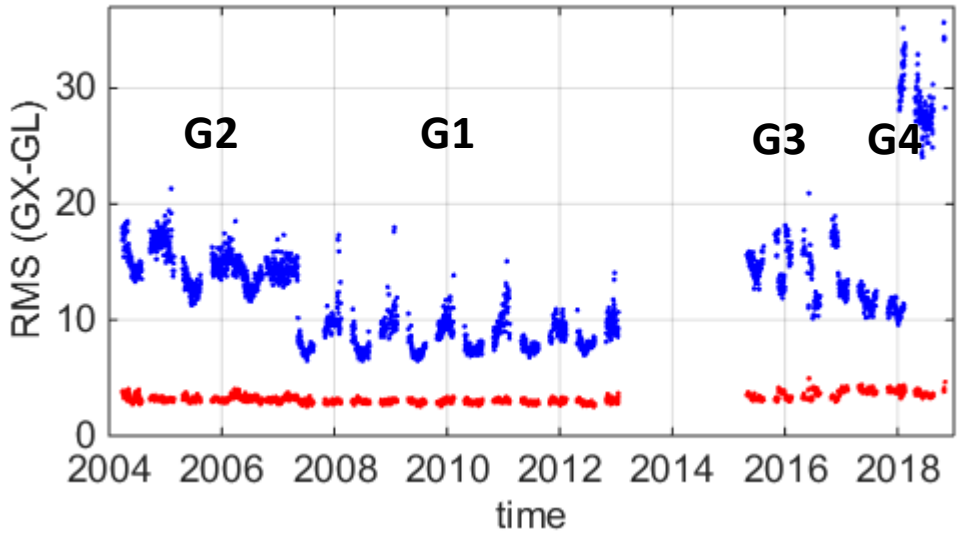
- For all instruments: LW better than SW.
- The RMS of LW is very stable (mean rms between 3.0 and 3.6).
- No significant difference between day- and nighttime measurements (mean ratio 0.99 – 1.01).
- Correction for Ed1 of G1 and G2 available (see Quality Summary, Russell et al., 2017).

Validation: GERB – GERB-like: L2, HR, 12:00 UTC

Ratio flux GX/GL **corrected** SW LW



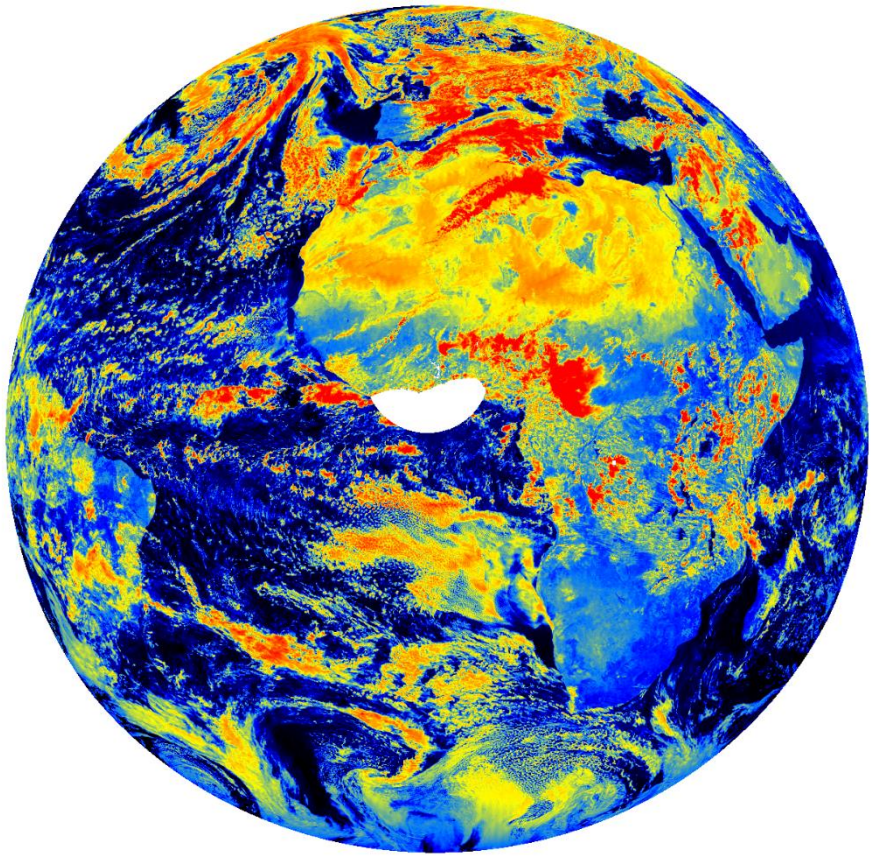
RMS (GX-GL)



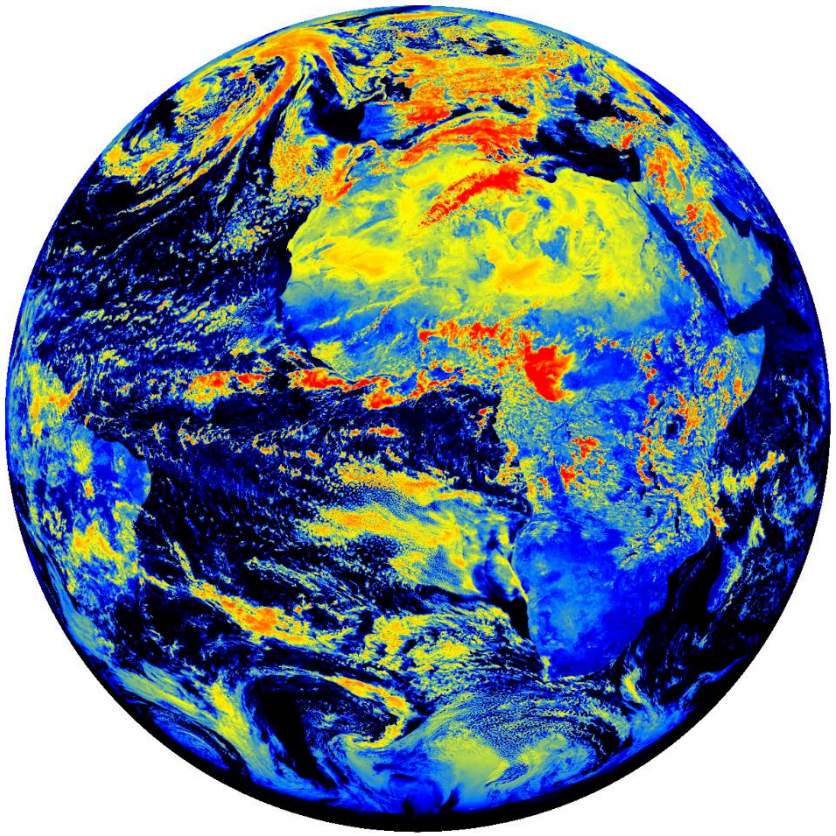
- For all instruments: LW better than SW.
- The RMS of LW is very stable (mean rms between 3.0 and 3.6).
- No significant difference between day- and nighttime measurements (mean ratio 0.99 – 1.01).
- Correction for Ed1 of G1 and G2 available (see Quality Summary, Russell et al., 2017).
- G3 and G4 show “jumps” in data → investigation ongoing, probably due to quartz filer position?
- G4: too bright → overestimation SW by 18 %.

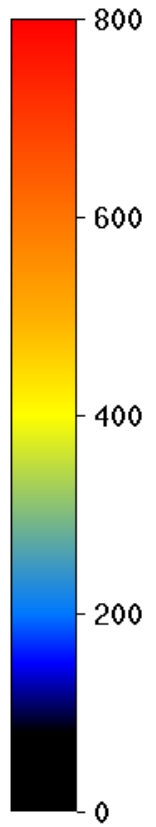
Validation: GERB – GERB-like

G4 SW 201905031200



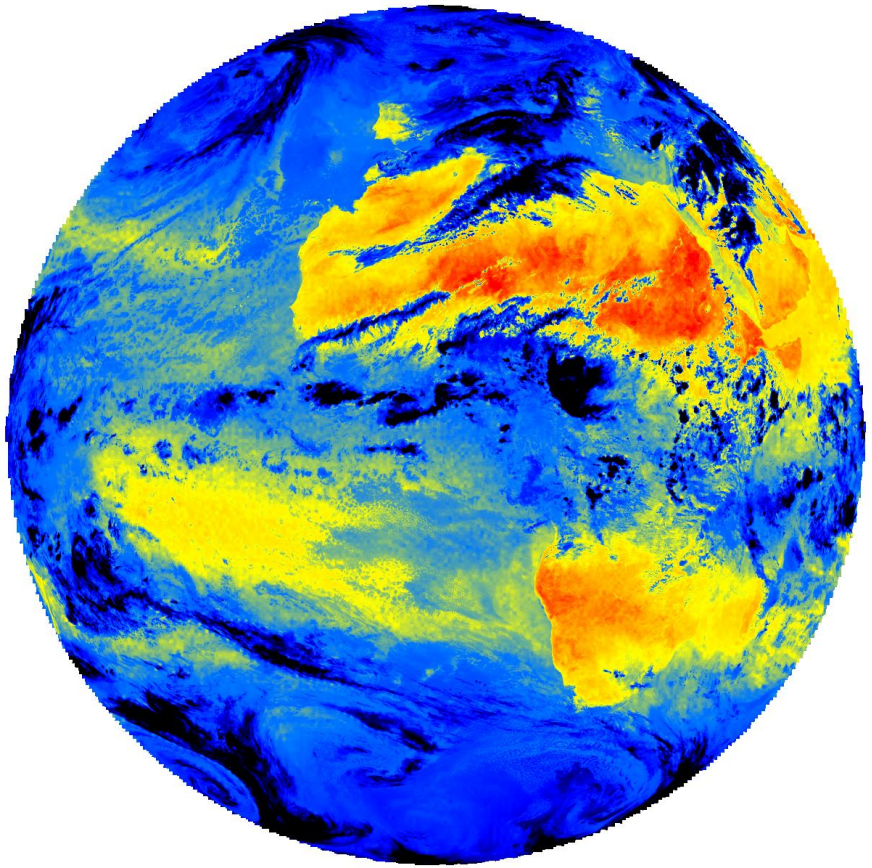
GL SW 201905031200



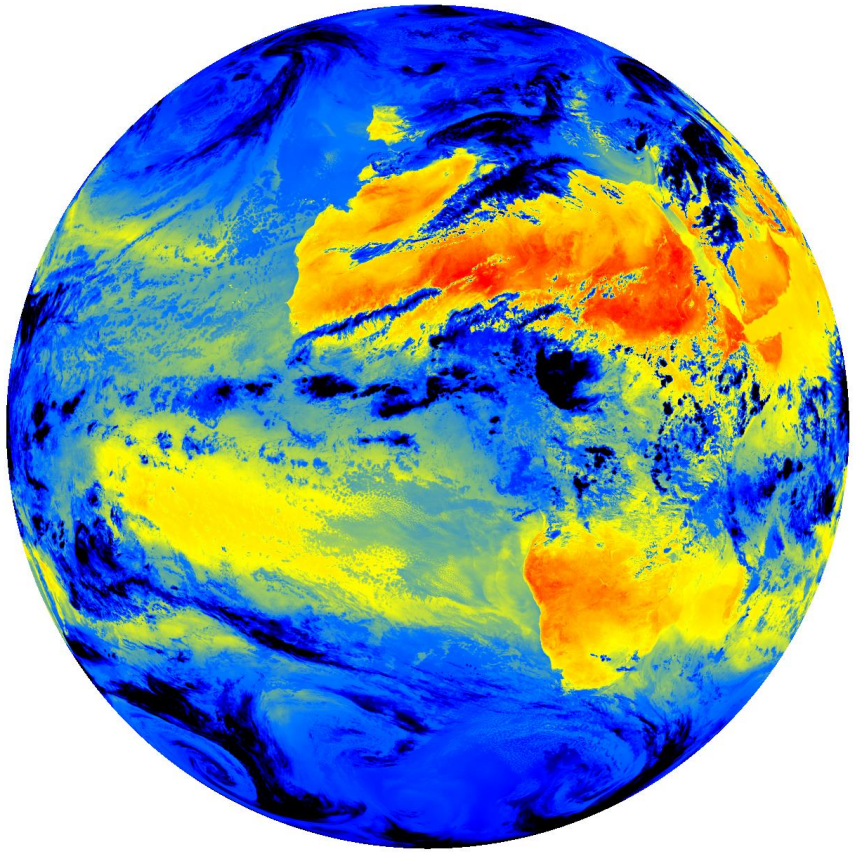


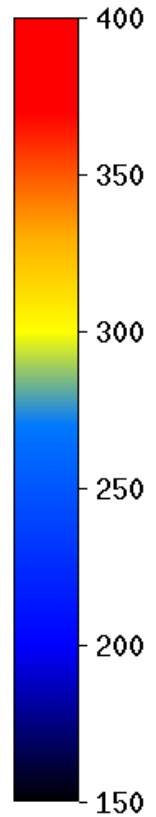
Validation: GERB – GERB-like

G4 LW 201905031200

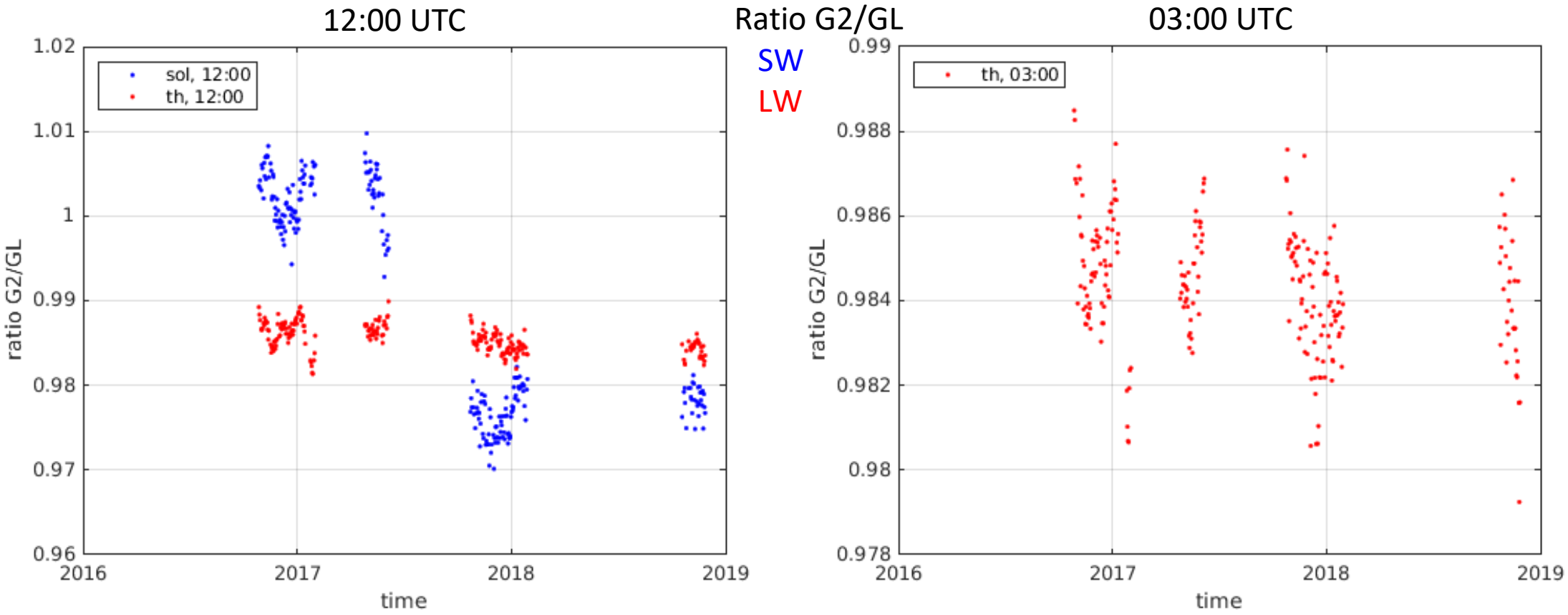


GL LW 201905031200



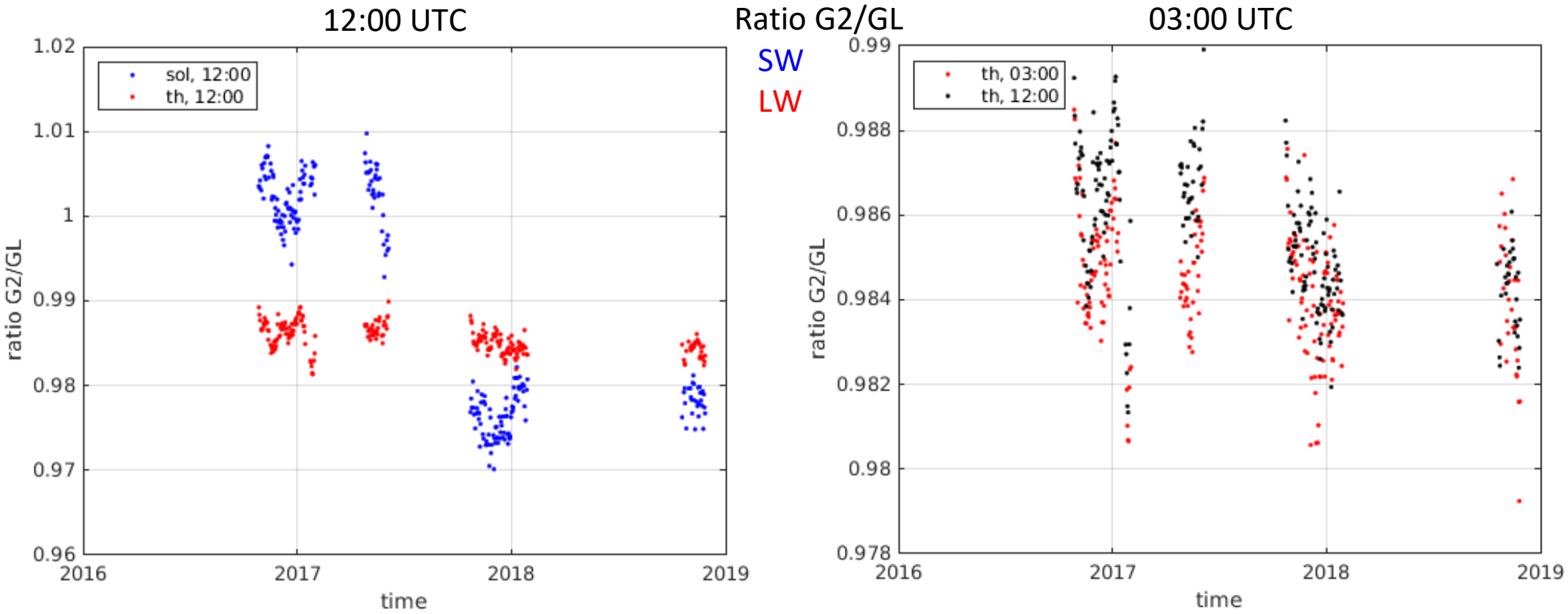


Validation: GERB – GERB-like: L2, HR, 03:00 UTC



- G2 LW around 1.5 % lower than GL.
- Change of the SEVIRI calibration in the SW channels on 16/08/2017 → «jump» in ratio.

Validation: GERB – GERB-like: L2, HR, 03:00 UTC



- G2 LW around 1.5 % lower than GL.
- Change of the SEVIRI calibration in the SW channels on 16/08/2017 → «jump» in ratio.
- Negligible difference in LW between day and night.

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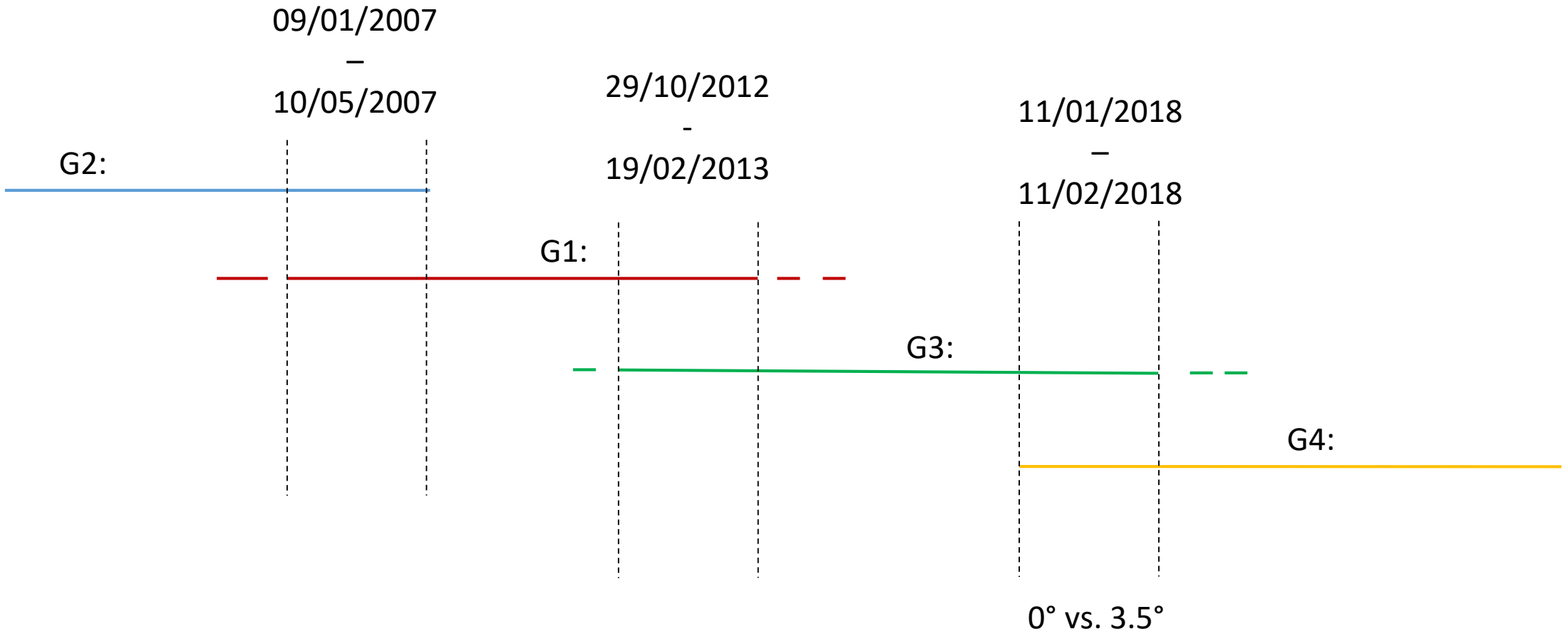
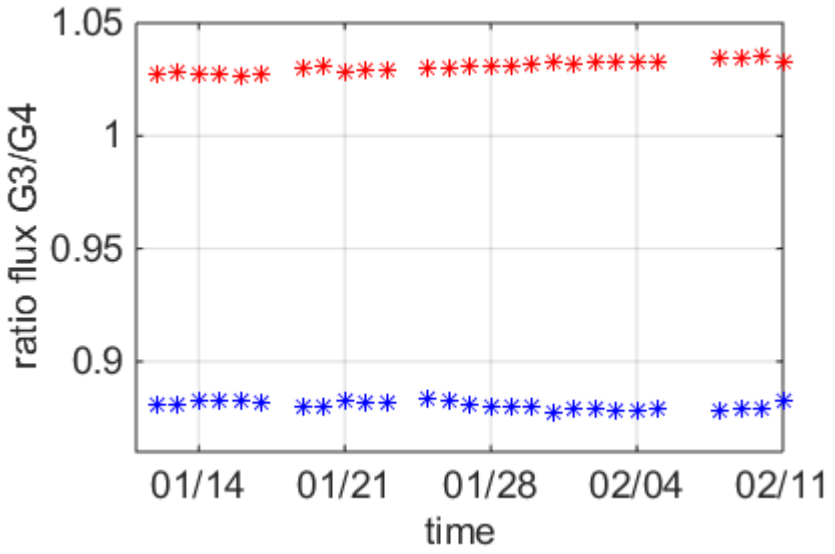
ERA5:
- Reanalysis data

Validation: GERB – GERB in overlap period

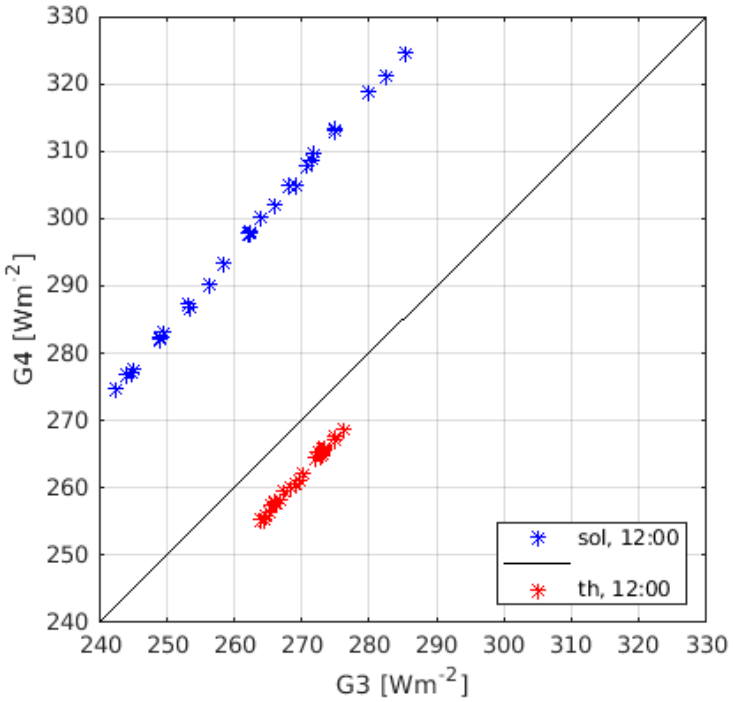


Validation: GERB 3 – GERB-4 in overlap period: L2, HR

12:00 UTC, image mean



LW: mean ratio = 1.03
SW: mean ratio = 0.88

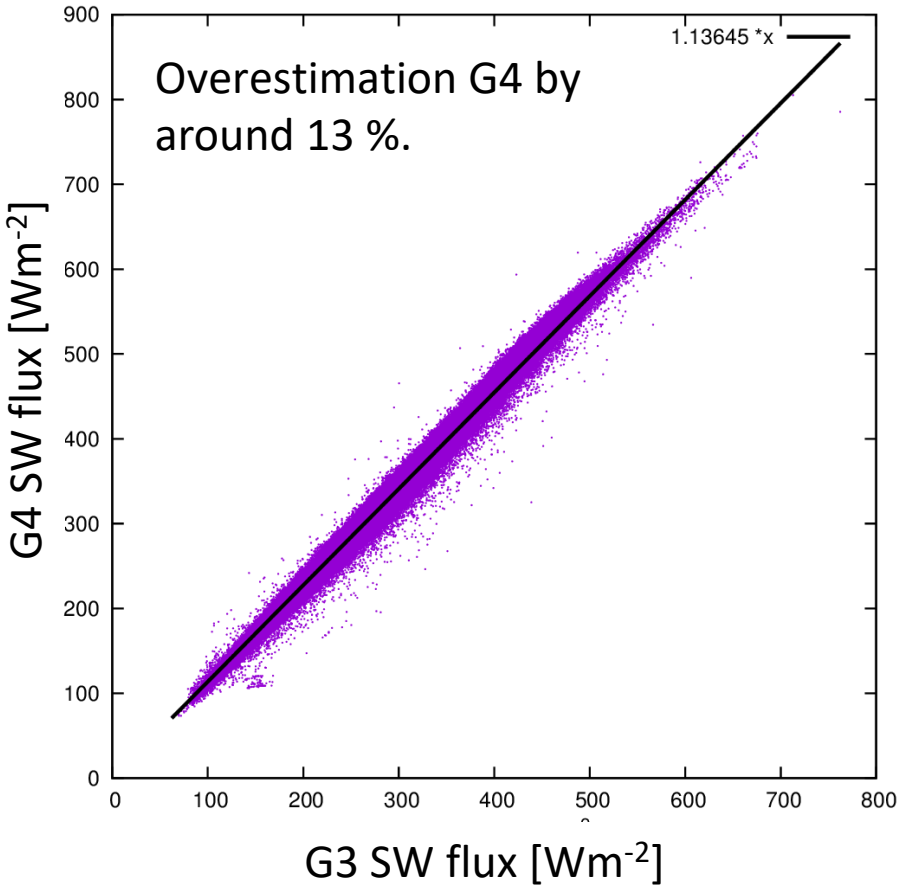


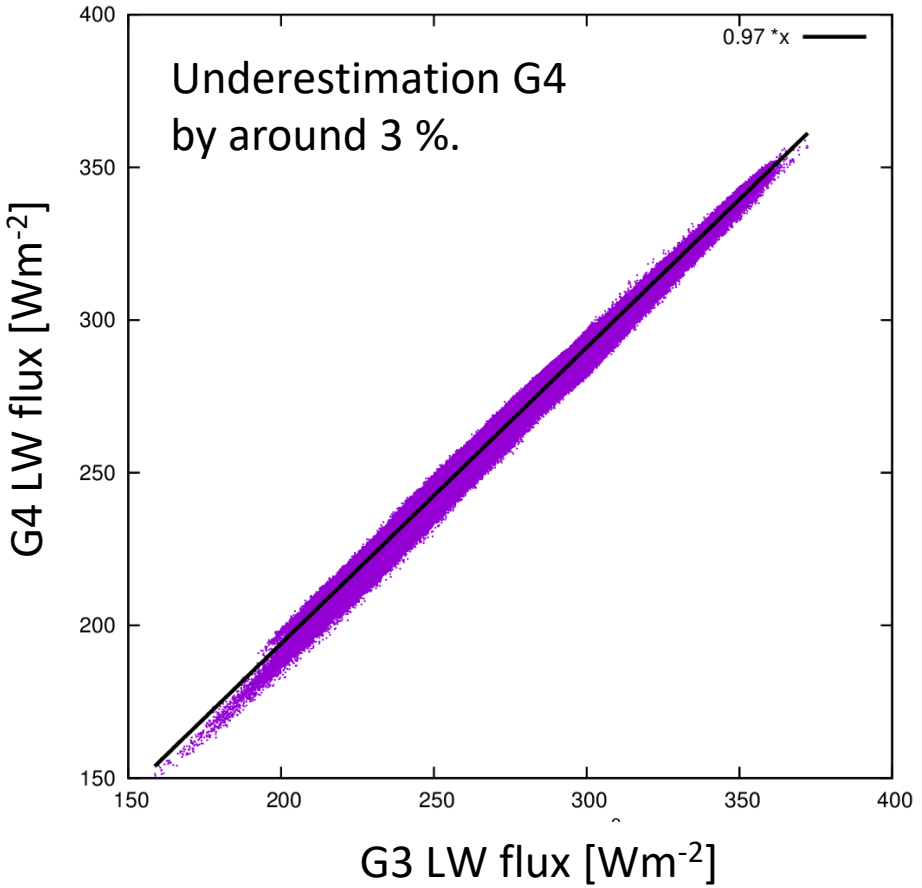
LW: r = 0.9996, y = 1.1724x - 9.5613
SW: r = 0.9975, y = 0.8997x + 34.2471

- Clear offset in G4 SW-flux in comparison to G3 SW-flux.
- LW flux good correlation during day and night (not shown).

Validation: GERB 3 – GERB-4 in overlap period: L2, HR

Pixel-level comparison





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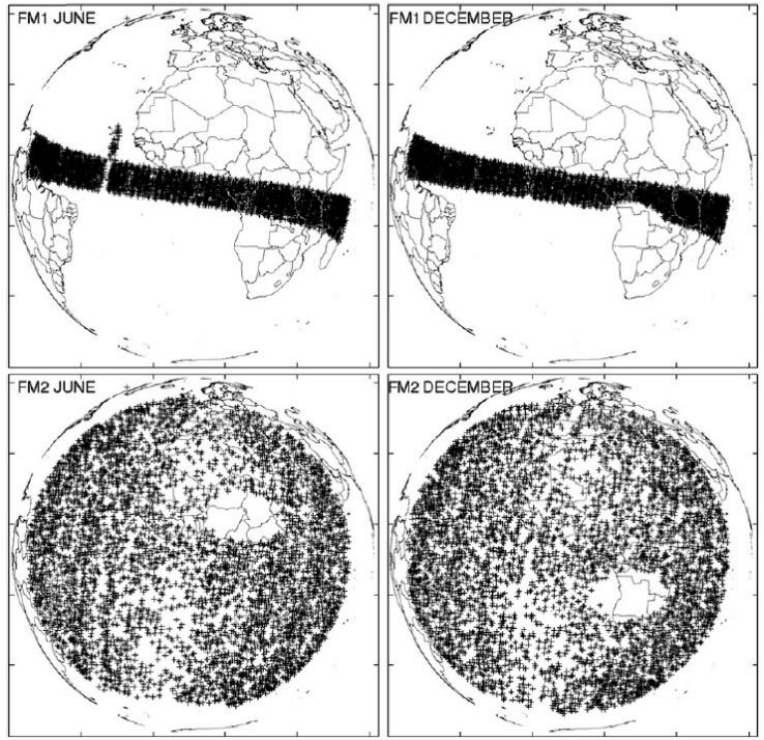
ERA5:
- Reanalysis data

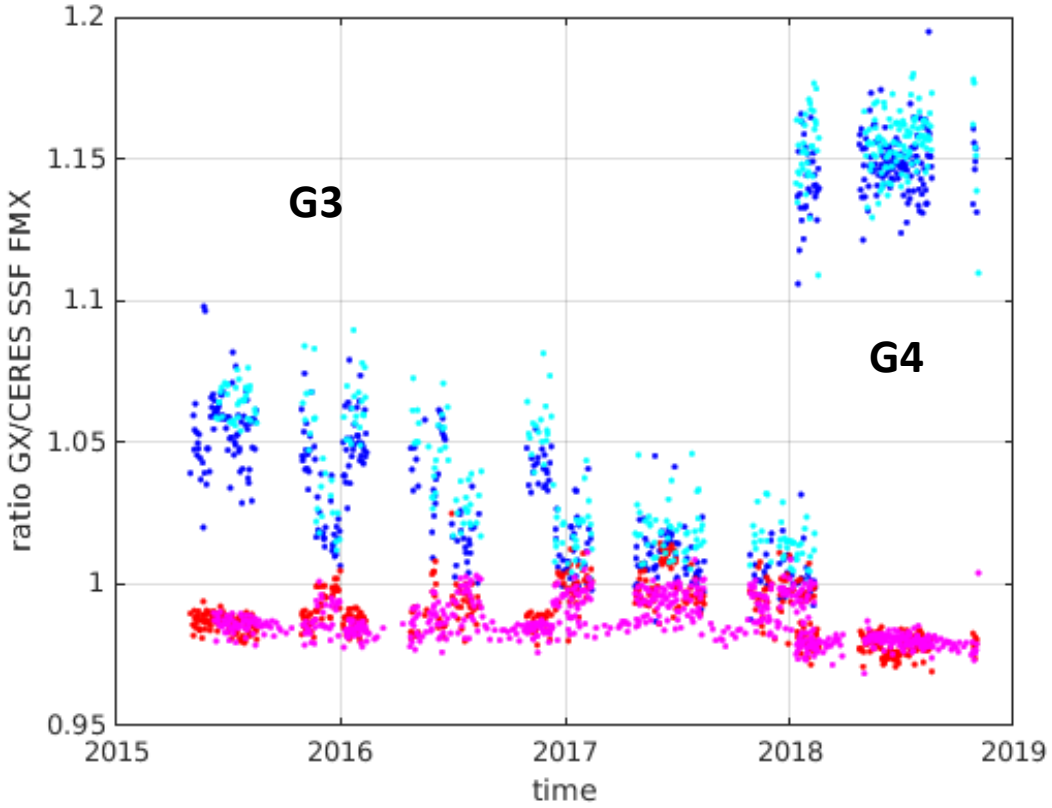
Validation: GERB-3/4 L2 HR – CERES SSF FM2/3

- Matching CERES Ed4 and GERB-data:
- HR is 9 km → integration to CERES PSF (~20km).



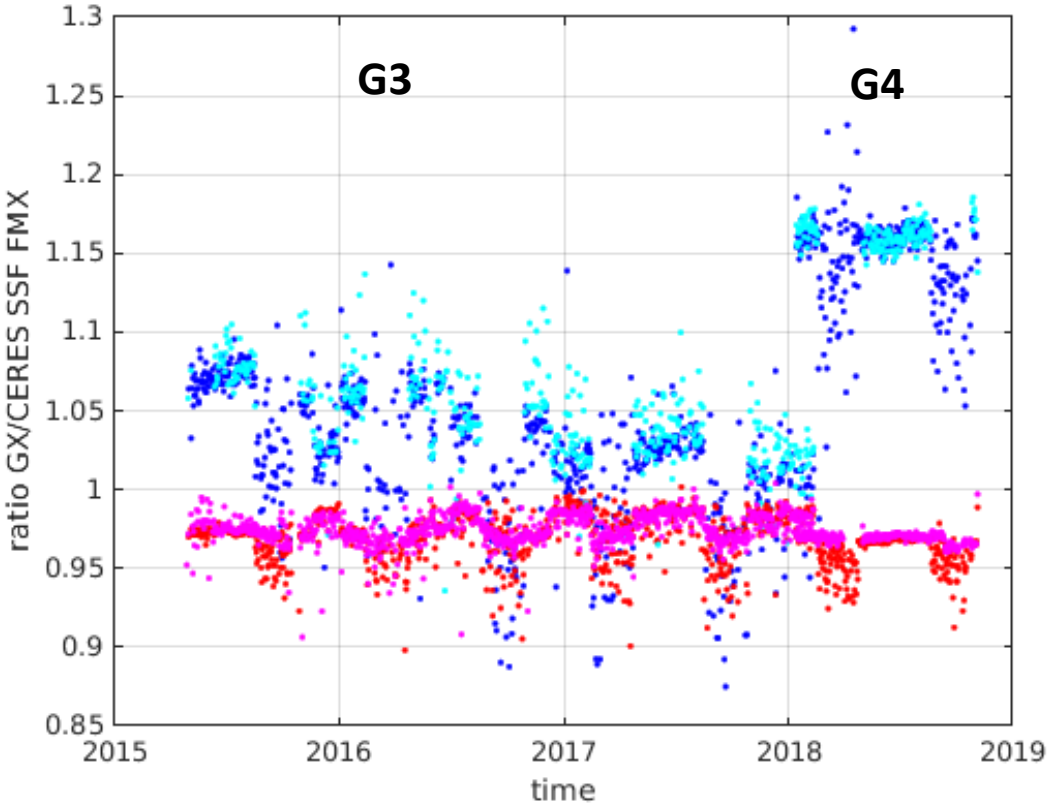
Validation: GERB-3/4 L2 HR – CERES SSF FM2/3

radiance



- SOL/FM2
- SOL/FM3
- TH/FM2
- TH/FM3

flux



- Overestimation SW of G3 in comparison to CERES SSF FM2 and FM3 (5 %).
- Overestimation SW of G4 in comparison to CERES SSF FM2 and FM3 (15 %).
- No significant difference between radiance and flux comparison.
- Ageing of SW G3.

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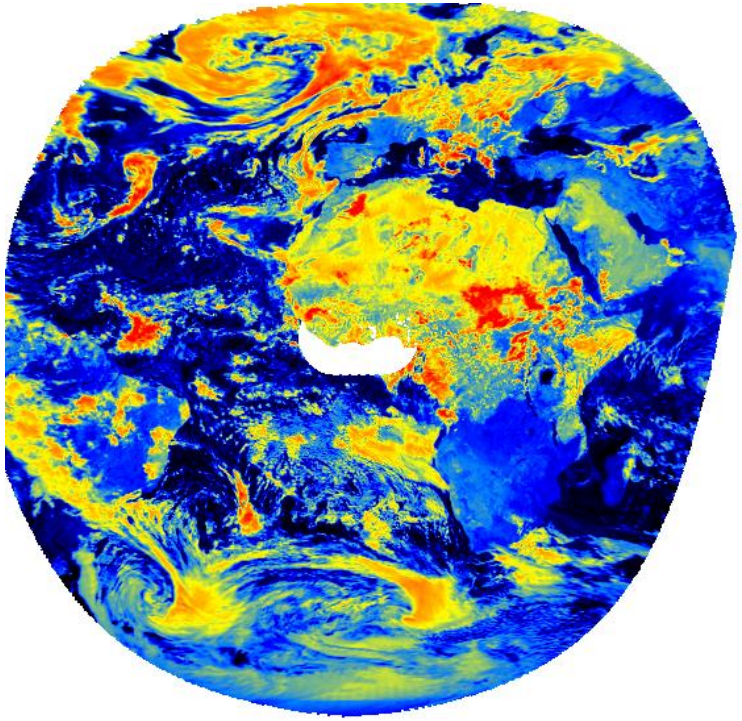
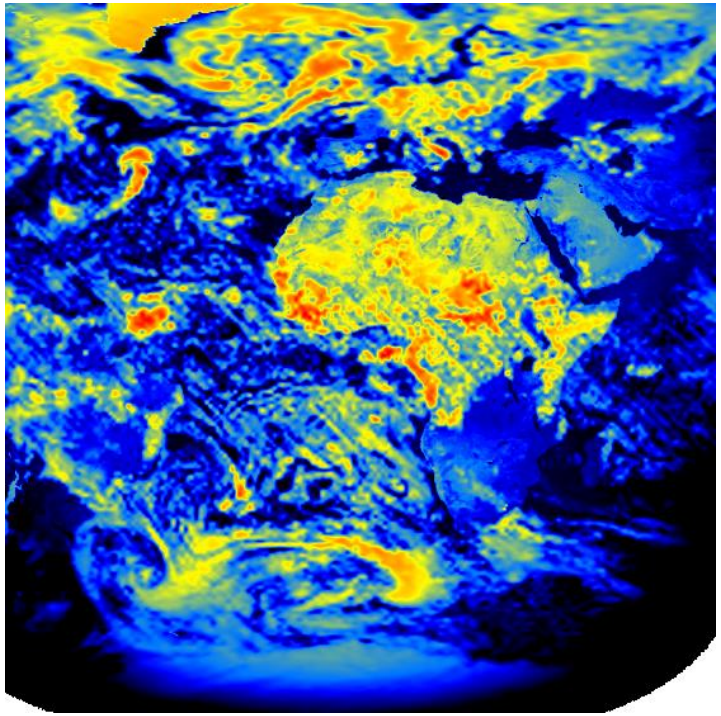
Validation: GERB – ERA5

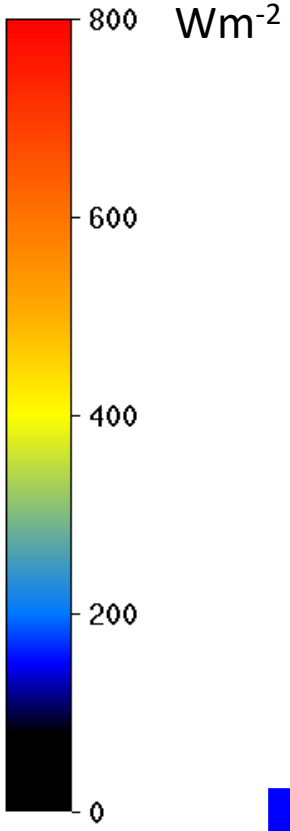
- ERA5: Atmospheric reanalysis data set from ECMWF
  - ➢ We are using a spatial resolution of 0.25° x 0.25° and hourly averages (12-13 UTC).

G4 SW 201818151200



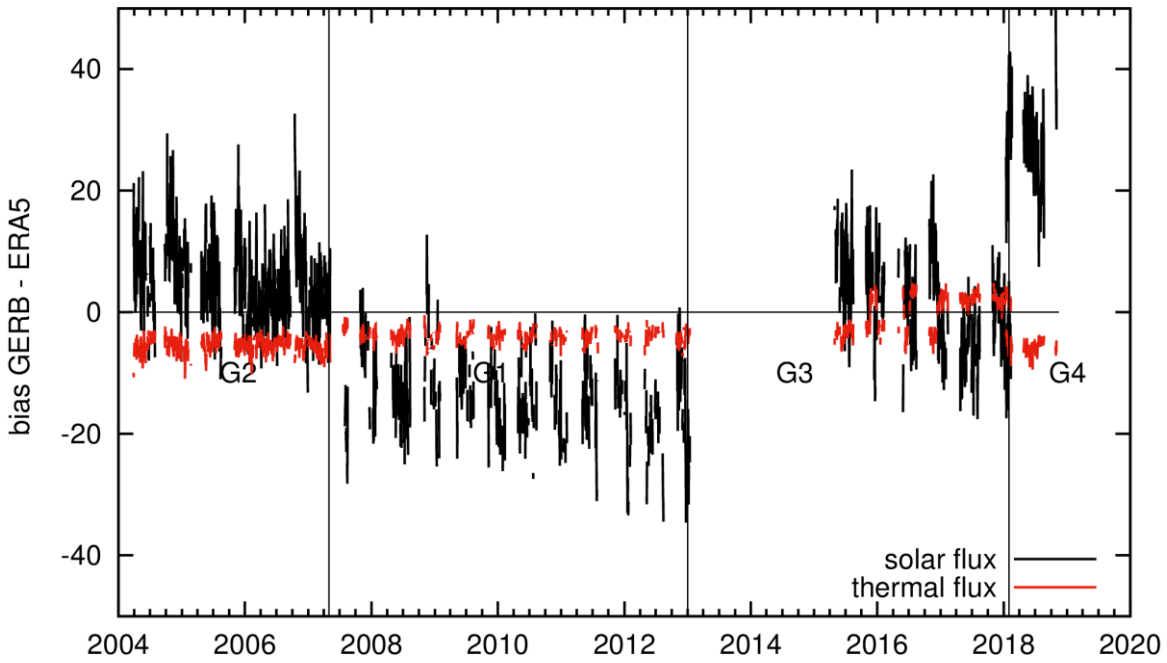
ERA5 SW 201808151200



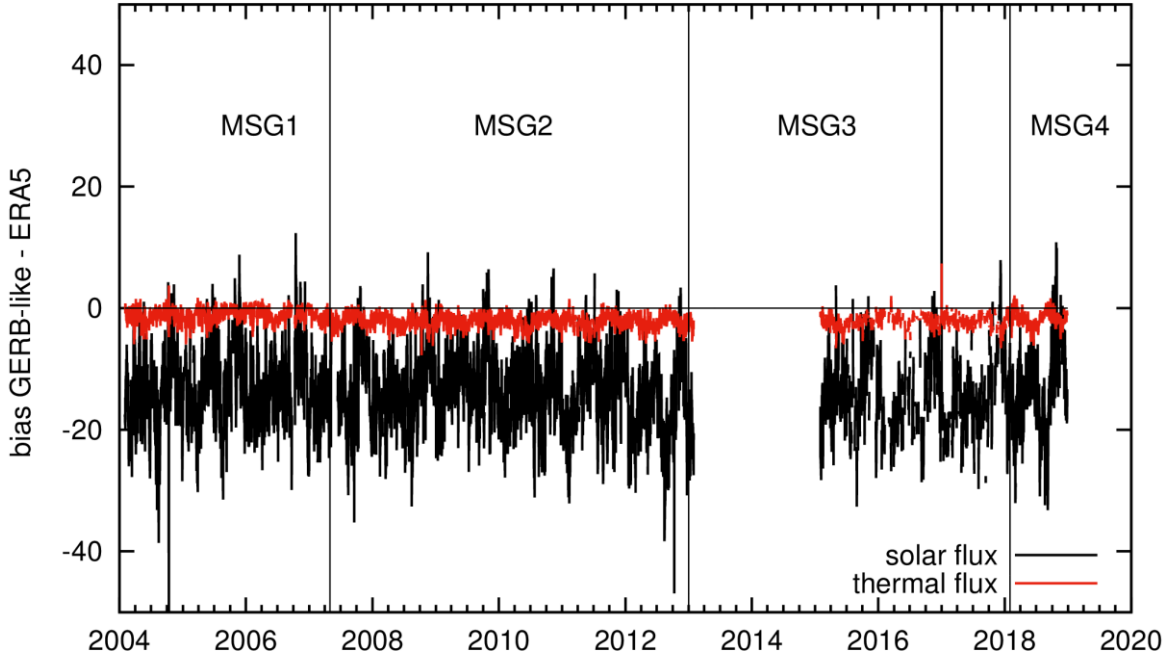


Validation: GERB – ERA5

Bias GERB 1 - 4



Bias GERB-like



- Shows similar tendency as GERB – GL comparison:
  - Better agreement in LW than in SW.
  - SW of G4 is too bright.
- No differences in the GL bias between instruments.

Conclusions and Outlook

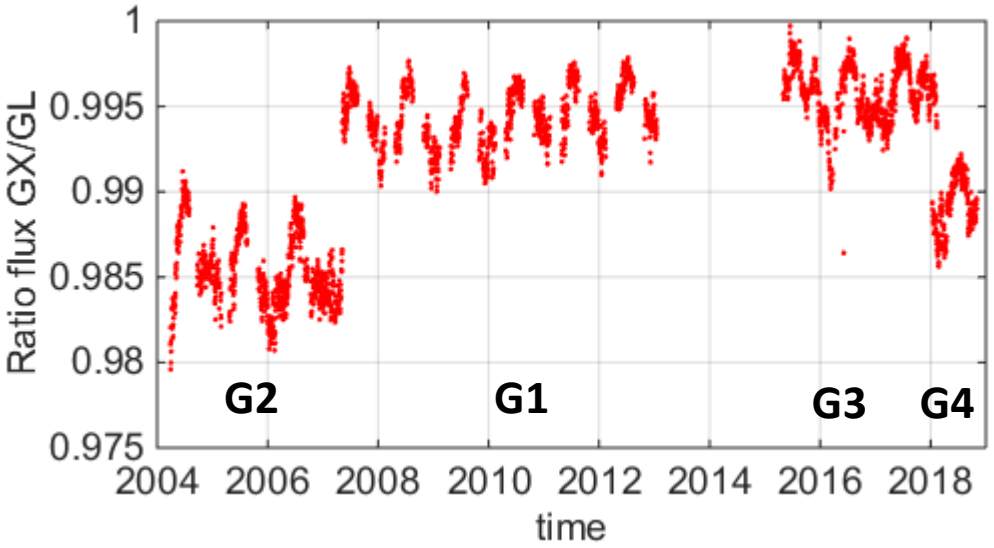
- Planned to do a comprehensive validation of all GERB instruments.
- Important to do intercomparisons with several sources of data.
- CERES can be seen as standard reference, but due to matching not all problems can be seen.
- Therefore, comparisons of GERB with GERB-like, overlap period, etc. are also needed to get the global picture.
- GERB-3 and GERB-4 still need some investigations (possibly reprocessing?) before release.

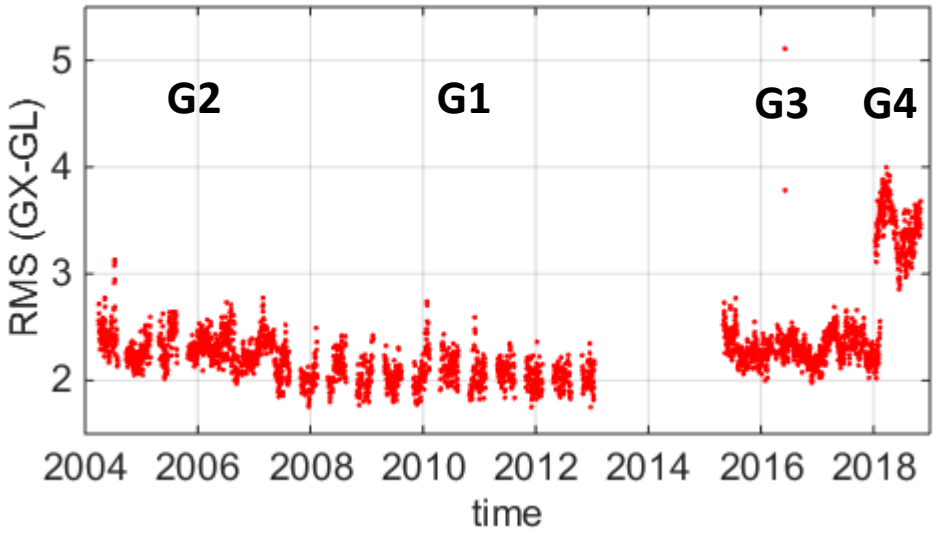
Validation: GERB – GERB-like: L2, HR, 03:00 UTC

Ratio flux GX/GL

LW

RMS (GX-GL)





- Also no significant difference between the instruments.

Validation: GERB – ERA5